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# Tulsa Tornado Tribune

"Where People Who Know The Weather Get Their Weather"

National Weather Service Tulsa, Oklahoma — Winter, 2005

## SKYWARN Recognition Day

SKYWARN Recognition Day (SRD) celebrates the contributions that volunteer SKYWARN storm spotters make to the National Weather Service's severe weather program. In eastern Oklahoma and northwest Arkansas, hundreds of volunteer storm spotters relay real-time information about severe thunderstorm structure and ground truth reports directly to our warning forecasters. The information that spotters relay to us is used to supplement Doppler radar data and near-storm environmental data in our severe weather warning and forecast decisions. We appreciate all the spotters who help us accomplish our mission.

SRD is an annual event that was developed by the National Weather Service and the American Radio Relay League in 1999. Our office participated in this national event again this year. Some of the activities that occurred in conjunction with SRD this year included a weather/ amateur radio balloon launch, chase, and recovery conducted by the Oklahoma Research Balloons. We also conducted local UHF/VHF amateur radio operations much of the day, made contacts on HF amateur radio bands to locations as far away as Maine, conducted an amateur radio severe weather exercise, and held an open house in our office. Several dozen spotters and amateur radio operators participated in the various activities that occurred during the day. Special thanks to Joel Genung and

*(Continued on page 3)*

*Photo courtesy of Joel Genung*

Harry Mueller prepares the weather/ amateur radio balloon for launch from outside the NWS Tulsa office.

### Editor's Notes

**SKYWARN training sessions for 2005 are getting underway, and we strongly encourage you to attend a session in your area. See page 3 for details.**

**As always, we thank you for your support during the many severe weather events during the past year, and we look forward to working with all of you in 2005!**

**Craig A. Sullivan - Editor**

### Inside this issue:



## 2004 Weather in Review

Overall, 2004 will go down as being wetter and slightly warmer than average over all of eastern Oklahoma and western Arkansas. More specifically, this was the 12th wettest year on record at Tulsa, and 13th wettest year at Fort Smith. Temperature departures from normal were not quite as dramatic, with neither location reaching the top 25 warmest years.

Like most years in this area, 2004 was not short on variety. Hidden within the annual temperature and precipitation statistics were several significant monthly anomalies. May and September, normally two of the wettest months of the year, both saw significantly below normal rainfall, while the summer months in between were much wetter than normal. Temperatures followed suit, as the spring and fall months were warmer than normal, while the summer turned out to be one of the coolest on record.

**JANUARY** was a month of extremes, but for the most part was warmer and wetter than normal. The year started with record warmth over much of the region, but the warm spell ended abruptly on the 4th, when a strong cold front brought a return to winter. By the morning of the 6th, some locations saw the coldest temperatures of the entire year. The first significant snowfall of the year occurred on the 26th, when 1 to 3 inches fell across parts of northeast Oklahoma.

**FEBRUARY** precipitation was below normal across northeast Oklahoma and northwest

*(Continued on page 6)*

# Winter Weather Product Definitions

Like most locations in the southern United States, winters are generally considered mild in eastern Oklahoma and western Arkansas. However, this does not preclude extended periods of freezing temperatures and wintry precipitation from occurring. In fact, as we have seen several times already this winter, weather can vary quite dramatically from week to week and from day to day during the winter months. Through December, January and February, cold fronts frequently move through the region and are often accompanied by strong, gusty northerly winds and sharp drops in temperature. These frigid weather systems can rapidly bring long periods of intense cold, as well as heavy snow and ice, (and the occasional bout of severe weather) from polar regions into Oklahoma and Arkansas, often immediately following a period of very pleasant and warm weather.

The National Weather Service office in Tulsa has already issued a handful of winter weather products this winter for eastern Oklahoma and western Arkansas, and more are certain to follow in the coming weeks. In order to effectively prepare for developing adverse winter weather, it is important that you understand what the various products mean. Here is a summary of the conditions that are expected when the given product is issued for your area.

**WINTER STORM WATCH**: Significant and potentially dangerous winter weather is possible in the 12 to 48 hour timeframe. Heavy snow and/ or heavy accumulations of ice and sleet are possible.

**WINTER STORM WARNING**: Significant and potentially dangerous winter weather is likely within the next 30 hours. Four inches or more of snow and/or significant accumulations of ice and sleet are likely. If mainly one precipitation type is expected, the warning may be issued as an event specific warning, such as Ice Storm Warning or Heavy Snow Warning.

**BLIZZARD WARNING**: The combination of heavy snow and strong wind will result in blindingly low visibilities less than one quarter of a mile and dangerously low wind chills during the next 24 hours.

## Right Around the Corner

Spring will officially begin on Sunday, March 20, at 6:33 A.M CST.

**Wind Chill Chart**

Wind (mph)

| Temperature (°F) | Calm | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | 36 | 34 | 32 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 25 | |
| 35 | 31 | 27 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 19 | 18 | 17 | |
| 30 | 25 | 21 | 19 | 17 | 16 | 15 | 14 | 13 | 12 | 12 | 11 | 10 | |
| 25 | 19 | 15 | 13 | 11 | 9 | 8 | 7 | 6 | 5 | 4 | 4 | 3 | |
| 20 | 13 | 9 | 6 | 4 | 3 | 1 | 0 | -1 | -2 | -3 | -3 | -4 | |
| 15 | 7 | 3 | 0 | -2 | -4 | -5 | -7 | -8 | -9 | -10 | -11 | -11 | |
| 10 | 1 | -4 | -7 | -9 | -11 | -12 | -14 | -15 | -16 | -17 | -18 | -19 | |
| 5 | -5 | -10 | -13 | -15 | -17 | -19 | -21 | -22 | -23 | -24 | -25 | -26 | |
| 0 | -11 | -16 | -19 | -22 | -24 | -26 | -27 | -29 | -30 | -31 | -32 | -33 | |
| -5 | -16 | -22 | -26 | -29 | -31 | -33 | -34 | -36 | -37 | -38 | -39 | -40 | |
| -10 | -22 | -28 | -32 | -35 | -37 | -39 | -41 | -43 | -44 | -45 | -46 | -48 | |
| -15 | -28 | -35 | -39 | -42 | -44 | -46 | -48 | -50 | -51 | -52 | -54 | -55 | |
| -20 | -34 | -41 | -45 | -48 | -51 | -53 | -55 | -57 | -58 | -60 | -61 | -62 | |
| -25 | -40 | -47 | -51 | -55 | -58 | -60 | -62 | -64 | -65 | -67 | -68 | -69 | |
| -30 | -46 | -53 | -58 | -61 | -64 | -67 | -69 | -71 | -72 | -74 | -75 | -76 | |
| -35 | -52 | -59 | -64 | -68 | -71 | -73 | -76 | -78 | -79 | -81 | -82 | -84 | |
| -40 | -57 | -66 | -71 | -74 | -78 | -80 | -82 | -84 | -86 | -88 | -89 | -91 | |
| -45 | -63 | -72 | -77 | -81 | -84 | -87 | -89 | -91 | -93 | -95 | -97 | -98 | |

*Frostbite occurs in 15 minutes or less*

**WINTER WEATHER ADVISORY**: A combination of snow amounts of three inches or less and light accumulations of ice or sleet will likely result in hazardous conditions in the next 30 hours.

**WIND CHILL ADVISORY**: Wind chill values generally colder than -5° F are expected.

Winter weather information can be obtained through other products as well. For example, when a winter storm is anticipated in the 2 to 5 day timeframe, but details are uncertain to the exact track of the system are uncertain, the outlook period of the **HAZARDOUS WEATHER OUTLOOK** will contain information on the possible upcoming storm. A **SPECIAL WEATHER STATEMENT** may also be issued under these circumstances.

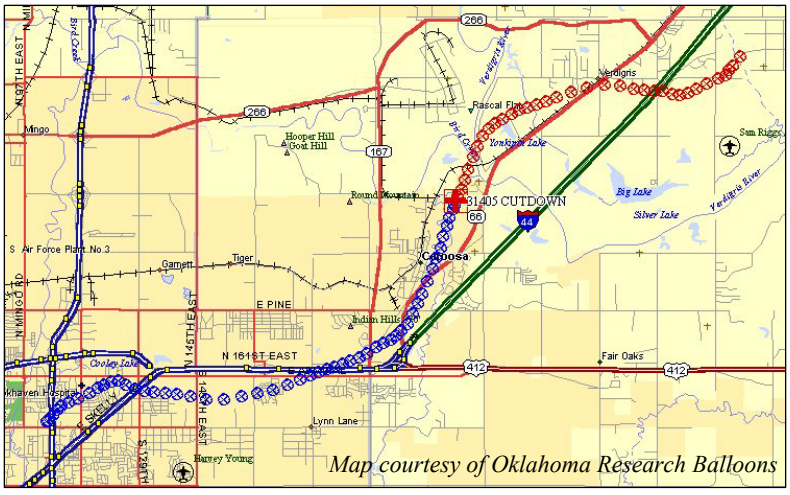
Staying one step ahead of winter storms by monitoring the latest forecasts and winter weather watches, warnings and advisories will allow you and your family to be better prepared for adverse conditions this winter. NOAA weather radio will enable you to receive this information from the national weather service 24 hours a day. You may also keep up to date by checking the NWS Tulsa website. ❄

# Spring 2005 SKYWARN Training Schedule

Yes, it's already that time of year again! A number of SKWARN Spotter meetings have already been scheduled . If you haven't already scheduled your training meeting for the 2005 spring season, please call Ed Calianese at **918-832-4133**. Since we emphasize different aspects of severe thunderstorm processes as they relate to spotting each season, we urge storm spotters to try to attend training meetings every year. Training will continue through the end of March. Below are the meetings that we currently have scheduled. **Please keep checking our website for additional scheduled meetings.**

| Date | County | City | Time | Location |
|---|---|---|---|---|
| Thursday Jan. 20 | Tulsa, OK | Glenpool | 7:00 pm | Glenpool EOC |
| Monday Jan. 24 | Creek, OK | Sapulpa | 7:00 pm | Collins Building |
| Tuesday Jan. 25 | Tulsa/Osage, OK | Sand Springs | 7:00 pm | Sand Springs EOC |
| Thursday Jan. 27 | Franklin, AR | Charleston | 7:00 pm | Charleston High School |
| Saturday Jan. 29 | Tulsa, OK | Tulsa | 9:00 am | Tulsa County Sheriff's Office |
| Monday Jan. 31 | Ottawa, OK | Miami | 7:00 pm | Miami Civic Center |
| Tuesday Feb. 1 | Washington, AR | Fayetteville | 7:00 pm | University of Arkansas, Engineering Building |
| Thursday Feb. 3 | Pawnee, OK | Westport | 7:00 pm | Westport Community Center |
| Monday Feb. 7 | Wagoner, OK | Wagoner | 7:00 pm | Wagoner Civic Center |
| Tuesday Feb. 8 | Mayes, OK | Disney | 7:00 pm | Disney Community Center |
| Monday Feb. 14 | Choctaw, OK | Hugo | 7:00 pm | Lane Frost Institute |
| Tuesday Feb. 15 | Muskogee, OK | Muskogee | 7:00 pm | To Be Determined |
| Thursday Feb. 17 | Haskell, OK | Stigler | 7:00 pm | Vocational Training Center |
| Saturday Feb. 19 | Tulsa, OK | Tulsa | 9:00 am | Tulsa Technology Center, Riverside Campus |
| Tuesday Feb. 22 | Pushmataha, OK | Antlers | 7:00 pm | Antlers City Library |
| Saturday Feb. 26 | Washington, OK | Bartlesville | 9:00 am | To Be Determined |
| Monday Feb. 28 | Le Flore, OK | Poteau | 7:00 pm | Vocational Training Center |
| Tuesday Mar. 8 | Crawford, AR | Van Buren | 7:00 pm | Kibler Road Church of God |
| Thursday Mar. 10 | Rogers, OK | Claremore | 7:00 pm | OSU County Building |
| Tuesday Mar. 15 | Delaware, OK | Jay | 7:00 pm | Jay City Hall |
| Tuesday Mar. 22 | Benton, AR | TBD | 7:00 pm | To Be Determined |

## SKYWARN Recognition Day




Map depicting the track of the balloon launched from the NWS Tulsa as part of the SKYWARN Recognition Day festivities.

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Steve Miller Jr. for helping plan and coordinate this year's activities and to Harry Mueller for conducting a balloon launch during the event!

The balloon drifted east-northeast toward Catoosa, where its payload was manually released and fell back to earth with the help of its parachute. The payload was tracked by a variety of beacons and was recovered in a wooded area just east of I-44. The recovered instruments will likely soon make another trip into the upper atmosphere over eastern Oklahoma! ❄

Ed Calienese -
Warning Coordination Meteorologist

# Winter Forecasting Dilemma

Although severe winter storms are much more common in areas to our north, eastern Oklahoma and western Arkansas will experience some snow or ice just about every winter. One of the biggest challenges we face as forecasters is what type of precipitation to expect with a storm system during the winter. It seems from experience that the least common scenario is all snow, and that some sort of transition zone from rain, to sleet or freezing rain, to snow is usually present.

While winter storms can be beautiful, they can also be quite destructive, especially those that produce widespread freezing rain. I'm sure most of you still remember the ice storm of Christmas, 2000, which left thousands of residents without power and caused well over 100 million dollars in damage. So, what causes an ice storm and why is this area susceptible to them?

The vertical distribution of temperature is the key in determining the *type* of precipitation (rain, snow or freezing rain) that occurs at the surface during the wintertime. A common scenario that causes precipitation to develop in the winter is for relatively warm and moist air to be lifted over a dome of cold air near the surface (commonly referred to as overrunning). Under this setup, the temperature *increases* with height, many times by several degrees, before decreasing. This increase, then decrease is called and *inversion*. It is the depth and strength (the two are usually interrelated) of the warm layer aloft, along with the depth of the cold dome at the surface, that determine the type of precipitation at the ground.

So, let's look at three very simplified possibilities of temperature distribution, and what type of precipitation is observed in each one. (NOTE: In each image the green dashed line is the temperature in respect to elevation.) In the first case **(FIGURE 1)**, the surface temperature is 25°F and increases with height before decreasing. However, since the temperature remains below freezing throughout the entire depth, any precipitation that falls will remain as snow.

In the second case **(FIGURE 2)**, the surface temperature is slightly higher, 27°F. Also, as elevation increases, the temperature increases to a point where an elevated layer of the atmosphere is above freezing. As snow falls into the layer of air where the temperature is above freezing, the snowflakes partially melt. As the precipitation re-enters the sub-freezing air near the ground, it will re-freeze into ice pellets that bounce off the ground, commonly called sleet.

The third case **(FIGURE 3)** is when freezing rain will occur. Notice the warm layer aloft is deep with only a shallow layer of below freezing air at the surface. The precipitation can begin as either rain and/or snow but becomes all rain in the warm layer. The rain falls back into

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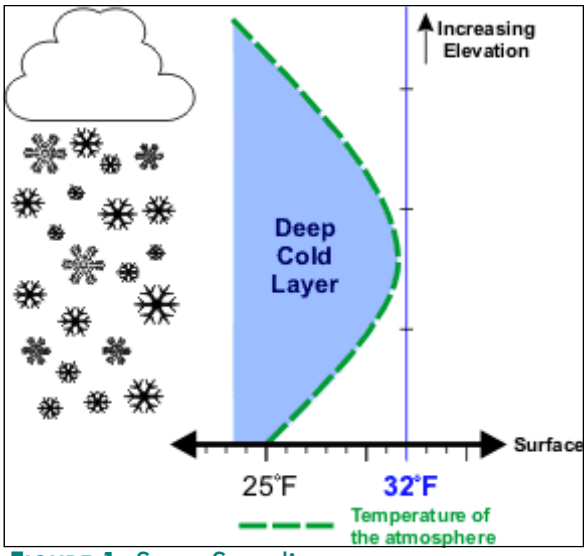


**FIGURE 1:** Snow Sounding

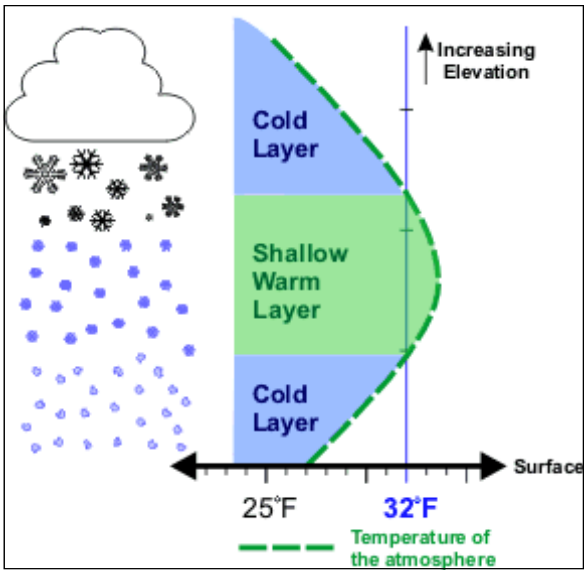


**FIGURE 2:** Ice Pellet (sleet) Sounding

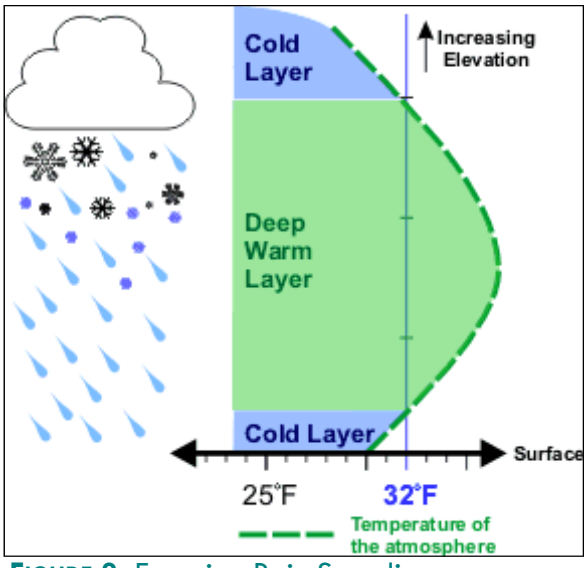


**FIGURE 3:** Freezing Rain Sounding

## Winter Dilemma

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the air that is below freezing but since the depth is shallow (about 1500 feet or less), the rain does not have time to freeze into sleet. Upon hitting the ground or objects such as bridges and vehicles, the rain freezes on contact, creating the glaze of ice we are all too familiar with. An important factor to consider is the *ground* temperature, which is sometimes warmer that the air temperature. In this case, it is common for elevated surfaces (power lines, bridges, etc.) to ice over, while the ground stays wet.

Studies have shown that if the maximum temperature of the warm layer aloft exceeds about 4 degrees Celsius (or about 40F), snowflakes tend to melt completely and precipitation reaches the ground as rain or freezing rain. If the warm layer temperature is between 1 and 3 degrees Celsius (about 33 to 39F), partial melting occurs resulting in sleet.

A mix of precipitation is common with winter storms in this part of the country largely because we are close enough to a source of warm moist air, the Gulf of Mexico, but just far enough north that intrusions of cold Canadian air occur with some regularity. However, these cold airmasses are often very shallow when they reach the southern plains. When a low pressure system draws warm, moist Gulf air north over the shallow cold air in place, a mixed bag of weather is usually the result.

Unfortunately, the atmosphere never behaves quite like the simple scenarios presented above. Normally a lot of subtle differences in the temperature structure exist over a given area, and a temperature change of only a degree or two can make all the difference in what type of precipitation occurs. Upper air observations are relied on heavily to forecast precipitation type, but these observations are taken only twice a day (every six hours upon special request), and observation sites are relatively sparse, usually about 200 to 300 miles apart. Conditions within the warm layer may (and usually do) vary significantly in time and distances much smaller than this. Forecast models do their best to fill in the gaps, but often have trouble estimating the strength of the warm layer. These factors make winter precipitation forecasting especially challenging. ❄

# New WCM Has Arrived

Although it is not obvious by the chaotic condition of his office, our new Warning Coordination Meteorologist (WCM) Ed Calianese arrived in Tulsa in early November. Ed replaced George Mathews who moved to eastern Tennessee to assume the duties of Meteorologist-in-Charge of the NWS Office in Morristown. Ed comes from the NWS Office in Lubbock, TX, where he served as both WCM and Lead Forecaster for almost seven years.

Before moving to Lubbock, he worked at the NWS offices in Fort Worth, TX and Asheville, NC. His primary interest in meteorology is severe thunderstorms and tornadoes, so he is very happy to be in eastern Oklahoma! Ed looks forward to working with all of our partners and customers over the coming years. ❄

## 2005 National Severe Weather Workshop

**Thursday, March 3 - Saturday, March 5, 2005**

The annual National Severe Weather Workshop will feature the nation's premier severe weather experts discussing their latest research and forecasting techniques. Designed for emergency managers, storm spotters and other weather enthusiasts, the workshop offers a unique opportunity to learn about NWS operations, severe weather preparedness and safety, StormReady, EMWIN, severe storm risks, lightning effects, wind damage effects and new ways to get radar data. Spotter training will be offered in conjunction with the workshop.

**www.norman.noaa.gov.gov/nsww2005**

# Better Late Than Never?

Did it seem that this fall you were cutting the grass or tending the garden later than usual. If so, you're probably right. At Tulsa International Airport, the temperature did not drop below freezing until November 24, the third latest occurrence of the first frost in history. This was close to the latest ever, (November 28, 1990), and well beyond the average date of the first frost (Nov. 3). Also, the 253 days between the last spring frost and first autumn frost was the second longest period on record.

Fort Smith recorded its first official frost on November 25, the 7th latest occurrence. Interestingly, this was the latest since 1935. The 257 day frost-free period was the 8th longest, and certainly well above the average of 222 days. ❄

## 2004

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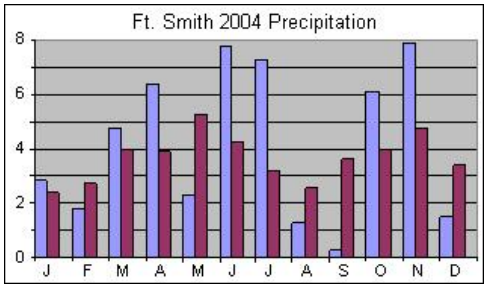
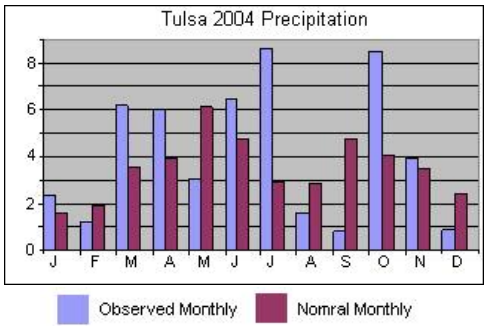
Arkansas, while all areas saw below normal temperatures, mainly during the first half of the month. A mix of freezing rain and sleet fell across far northwest Arkansas on the 4th and 5th, with as much as two inches of sleet and a quarter inch of ice accumulation in parts of Carroll and Madison counties. Another storm system brought 3 to 6 inches of snow to much of southeast Oklahoma on the 14th.

**MARCH** was considerably warmer than normal, but saw quite a variance in precipitation. In general, locations north of Interstate 40 saw above normal precipitation. Points to the south were less fortunate, with parts of southeast Oklahoma receiving less than half the monthly average. The first severe weather of the year occurred on the 4th, as a powerful line of thunderstorms brought damaging winds to much of southeast Oklahoma into western Arkansas, along with two small tornadoes. Flooding rains were a problem farther north, as 3 to 4 inches fell across much of northeast Oklahoma. Another round of severe storms battered the area on the 17th, this time mainly in the form of large hail.

**APRIL** saw its usual share of severe weather, with most of it occurring from the 20th to the 24th. The series of storms produced very heavy rainfall, especially across northwest Arkansas, resulting in considerable flash flooding across Washington, Franklin, Madison and Crawford counties. There were also numerous reports of large hail and damaging winds throughout the area, along with several tornadoes. Fortunately the tornadoes were of the weaker variety and damage was confined mainly to rural areas.

**MAY** was one of the driest on record, with some areas receiving less than 20 percent of normal rainfall. For Oklahoma, this was the second driest May on record. While May was less active than normal for severe weather, there were two notable episodes. The first occurred on the 13th, with numerous wind and hail reports throughout the area. One tornado was reported near Coweta, OK. Memorial Day weekend often brings severe storms, and this year was no exception. A single, powerful supercell moved across the entire state of Oklahoma on the 29th and produced a series of tornadoes, one of which was rated an F3 near Depew.




**JUNE** got off to a busy start, as a complex of storms on the 2nd brought widespread wind damage throughout eastern Oklahoma and west central Arkansas. Most hard hit was the Tulsa area, with over 4 million dollars in damage and some 70,000 residents without electricity at one point. The rest of the month saw plentiful rainfall, and finished well above normal.

**JULY** can be summed up as much cooler and wetter than normal. While there were a few stretches of the usual hot, humid weather, a good part of the month had a spring-like feel. Heavy rains produced significant flooding over portions of northwest Arkansas and east central Oklahoma on the 2nd and 3rd, putting a damper on the holiday weekend. An unseasonably strong cold front pushed through the area on the 24th and 25th, with several daily record low maximum temperatures established the last week of the month.

**AUGUST** saw a reversal of the precipitation trend, but continued the surprising run of cool summer temperatures, ending up as one of the coolest on record. Thanks to the unusual weather, both Tulsa and Fort Smith ended up in the top 10 coolest summers on record.

**SEPTEMBER** was just the opposite of the preceding months. Precipitation was much below normal, with the state of Arkansas as a whole recording its second driest September on record.

**OCTOBER** continued the trend of warm autumn temperatures, but precipitation reversed as parts of southeast Oklahoma and western Arkansas received more than twice the normal monthly rainfall. In fact, it was the fourth wettest October statewide for Arkansas.

**NOVEMBER** was another warm month, albeit a little on the gloomy side. Precipitation was again the big story for the month, with both Oklahoma and Arkansas recording their eighth wettest November. Severe thunderstorms on the evening of the 26th produced large hail and some wind damage in the Fort Smith area.

**DECEMBER** ended the year on a mild and dry note. Winter finally reared its ugly head just before Christmas as an arctic front brought much colder temperatures on the 23rd, along with 1 to 3 inches of snow over much of southeast Oklahoma and west central Arkansas. While they saw a rare white Christmas, the rest of the area was just plain cold, with lows dropping to the single digits by the 24th. By the end of the month, temperatures rebounded, ending 2004 much as it began. ❄